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ABSTRACT

Data presented in this report are derived from the National Science Foundation's (NSF) fall 1980 Survey of Graduate Science Students and Postdoctorates, covering 9,930 graduate science and engineering (S/E) departments in 633 doctorate- and master's-granting institutions. Highlights of the survey indicate that: (1) graduate enrollment in S/E exceeded 383,000 in fall 1980, a growth of 3 percent over fall 1979; (2) the total number of graduate students enrolled in engineering grew between 1979 and 1980 at about twice the rate of those in science fields as a whole; (3) 3 percent 1979-80 increase in full-time S/E graduates at doctorate-granting institutions was primarily fueled by the growing number of women enrolled in graduate S/E courses; (4) the number of foreign students enrolled full-time in doctorate-granting institutions increased by 9 percent between 1979 and 1980; (5) of the 231,000 S/E graduate students enrolled full-time, those holding research and teaching assistantships increased by 5 percent over 1979; and (6) federal agencies supported about 22 percent of all full-time S/E students in 1980, the same proportion as in 1979. (Author/JN)

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SCIENCE RESOURCES STUDIES HIGHLIGHTS

AL SCIENCE FOUNDATION WASHINGTON, D.C. 20550 MAY 12, 1982 82-306

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Graduate Science/Engineering Enrollment Up 3% Between 1979 and 1980

The data presented in this report are derived from the National Science Foundation's (NSF's) fall 1980 Survey of Graduate Science Students and Postdoctorates. Data cover 9,930 graduate science and engineering (S/E) departments in 633 doctorate- and master's-granting institutions. Separate data were obtained from 140 medical schools. Estimates for nonresponse account for only 3 percent of the graduate enrollment total shown in this report. The term "graduate enrollment" refers to the total number of full- and part-time students, unless otherwise specified.

Highlights

• Graduate enrollment in the sciences and engineering exceeded 383,000 in fall 1980, a growth of 3 percent over fall 1979, matching the average annual growth rate during the 1975-79 period. The number of graduate students in all fields—both science and nonscience—also rose by 3 percent from 1979 to 1980, representing a turnaround from the declines reported yearly from 1975 through 1979. The rise in graduate S/E enrollment is attributable to several factors, including greater participation of women and foreign students in graduate education and the continuing growth in academic R&D performance.

• The total number of graduate students enrolled in engineering grew between 1979 and 1980 at about twice the rate of those in science fields as a whole (4 percent compared to 2 percent). Between 1975 and 1979, by contrast, the average yearly rise in engineering was slightly lower than in the sciences. In 1980, graduate enrollment in mathematical/computer sciences showed the highest growth rate of all major fields, up 11 percent, compared to a lower than average growth in the previous four years. The acceleration in the rates of growth of graduate enrollment in computer sciences and engineering is occurring during a time of increasing shortages of faculty, some of whom are moving into industrial positions where salaries for Ph. D.-holders are higher.

• The 1979-80 pattern of growth in graduate S/E enrollment in doctorate-granting institutions, accompanied by a decline in master's-granting institutions, was in contrast to the preceding 4-year period when master's institutions registered enrollment gains at a faster pace than did doctorates.

• The 3-percent 1979-80 increase in full-time S/E graduate students at doctorate-granting institutions was primarily fueled by the growing number of women enrolled in graduate S/E courses. Their number has increased steadily at an average annual rate of about 8 percent between 1975 and 1980.

• The number of foreign students enrolled full time in graduate S/E programs in doctorate-granting U.S. institutions increased by 9 percent between 1979 and 1980, while the number of U.S. citizens grew by only 2 percent, continuing the pattern of the 1975-79 period. Foreign students constituted 21 percent of all full-time graduate S/E enrollment in 1980, up from their 16-percent share in 1975. In certain fields their proportion was considerably higher, constituting 42 percent of the engineering graduate students and 32 percent of the mathematical/computer sciences total.

• Of the 231,000 S/E graduate students enrolled full time at doctorate-granting institutions in fall 1980, those holding research assistantships and teaching assistantships increased by 5 percent each over fall 1979 and the number of fellows and trainees remained at the fall 1979 level. The growth in the number of research assistants nearly parallels the 4-percent constant-dollar increase in academic R&D expenditures between fiscal years 1979 and 1980.

• Federal agencies supported about 22 percent of all full-time graduate S/E students in 1980, about the same proportion as in 1979—the first year in which no perceptible growth has occurred since the survey series began in 1975. The number of students receiving support from non-Federal sources grew by 5 percent over 1979, primarily as the result of increases in institutional and State and local government support.

Total Graduate S/E Enrollment

The number of graduate students in S/E programs rose by 3 percent between 1979 and 1980, the same growth rate as the average annual increase between 1975 and 1979 (chart 1). Engineering graduate students increased by 4 percent between 1979 and 1980, double the 2-percent average annual growth rate from 1975 through 1979. Those enrolled for graduate study in the sciences as a whole increased by only 2 percent between 1979 and 1980, down from an average of 3 percent in the earlier years. Enrollment in all other graduate programs also increased between 1979 and 1980 by 3 percent, but this rise followed an average yearly decline of 7 percent during the period 1975-79 (table 1). The cyclical patterns of retrenchment and expansion in graduate enrollment in recent years are a reflection of students' adaptations to swiftly changing market forces as well as to changes in their demographic characteristics. The number of individuals in the 22-to-24-year-old cohort, the age group in which graduate students are generally represented, has been rising each year but at a gradually diminishing rate that has continued

(Prepared in the Universities and Nonprofit Institutions Studies Group, Division of Science Resources Studies)

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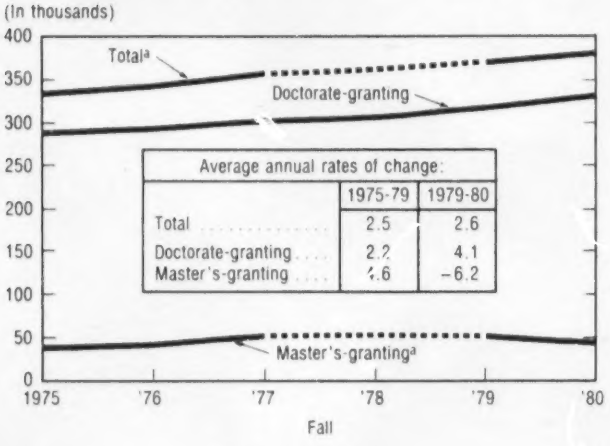
Chart 1. Graduate science/engineering enrollment by type of graduate institution



[a]Data for master's granting institutions interpolated for 1978.
SOURCE: National Science Foundation

Table 1. Total graduate enrollment at institutions of higher education by field

Field	Number			Average annual percent change	
	1975	1979	1980	1975-79	1979-80
Total, all graduate students	1,268,000	1,075,000	1,105,000	-4	3
Science/ engineering fields	338,000	373,000	383,000	3	3
Science	269,000	299,000	306,000	3	2
Engineering	68,000	74,000	77,000	2	4
All other fields	930,000	702,000	722,000	-7	3

NOTE: Detail may not add to total because of rounding.

SOURCES: National Center for Education Statistics, Department of Education, and National Science Foundation

through 1981. The expected downturn in the size of this segment of the population will eventually have an effect on graduate institutions, but this may be partially offset by a rise in the enrollment of the over-25-year-old population, especially on a part-time basis.[7]

In 1980, the number of first-year, full-time graduate S/E students in doctorate-granting institutions rose nearly 6 percent over 1979 but was still below the total for 1977, the peak year. The number of full-time students beyond their first year rose 2 percent between 1979 and 1980, continuing the increases which averaged 3 percent annually since 1975. The fields in which industrial demand is high showed the highest average annual growth rates in numbers of students beyond their first year: computer science graduate students increased by nearly 16 percent between 1979 and 1980; petroleum engineering students grew by almost 13 percent; and electrical engineering students increased by more than 11 percent.

AREAS OF SCIENCE/ENGINEERING

In doctorate-granting institutions, mathematical/computer science enrollment increased at the fastest rate between 1979 and 1980—11 percent—followed by psychology and engineering, each with a 5-percent increase. This is a substantial change from the 1975-79 pattern when enrollment in the life sciences was the fastest growing field, increasing at an average rate of 4 percent per year.

A recent NSF-sponsored survey indicates that the continuing growth in engineering enrollment in all institutions is placing a strain on teaching resources at a time when institutions are facing heavy competition from industry in the recruitment and retention of engineering faculty.[8] The 5-percent overall rise in graduate engineering students between 1979 and 1980 was accompanied by only a 2-percent gain in academic employment in engineering.[9] Three-fourths of this engineering enrollment growth can be attributed to increases in full-time enrollment, primarily foreign students.

The 19-percent growth in computer sciences enrollment in doctorate institutions was traced to an influx of part-time graduate students as well as to a rise in the number of women and foreign students enrolled full time. The increased faculty workload, class size, and expanding need for computer facilities that accompanies such rapid growth were only partially offset by a rise in professional staff, up 12 percent in the same year. Not all of these new appointees were engaged in teaching, however; some were hired as systems analysts working in computer centers to make more effective use of automated record systems to meet the growing demands for better management of academic resources. An NSF-sponsored review of the information management problems of higher education states "...The fastest growing segment of computing in higher education is not instruction, not research, but administration." It further concludes that "Increased public awareness of, and ability to use, computers will compel schools to incorporate new technologies in their services...."[10] The report predicts a growing shortage of computer science graduates to fill the projected openings in universities, private industry, and governments.

Patterns of Graduate Student Support

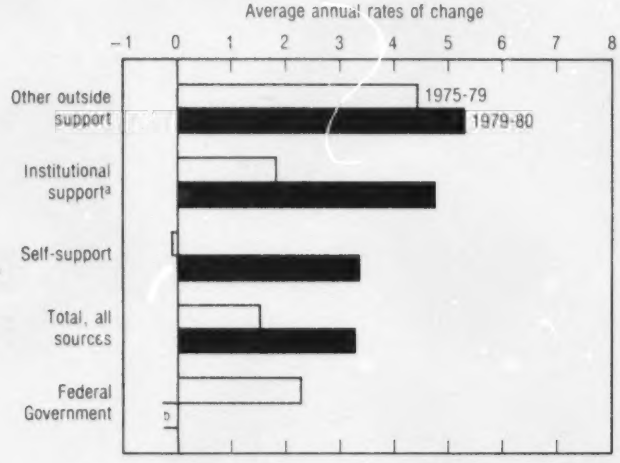
TYPES OF MAJOR SUPPORT

The number of full-time S/E graduate students in doctorate-granting institutions supported primarily through either research or teaching assistantships increased at a faster rate, 5 percent between 1979 and 1980,[6] than did those supported under other mechanisms.[7] In the case of research assistants, this increase can be traced largely to the steady 1975-80 growth in academic R&D expenditures (4 percent per year in constant dollars).[8] Those supported through other types of support (primarily self-support) increased by about 3 percent between 1979 and 1980, and those supported through fellowships and traineeships remained virtually level. Federal fellowships and traineeships declined by 2 percent per year between 1975 and 1980, offsetting a 2-percent rise per year in the number supported by other sources. The amount obligated by Federal agencies to universities for fellowships, traineeships, and training grants declined sharply between 1974 and 1976, but by 1979 had stabilized at about two-thirds of the 1974 level.[9]

SOURCES OF MAJOR SUPPORT

The number of full-time graduate S/E students in doctorate-granting institutions receiving primary support from the Federal Government remained level between 1979 and 1980.[9] Meanwhile, those receiving major support from their institutions or State and local governments (38 percent of the full-time total) rose by 5 percent between 1979 and 1980, about the same rate as those relying on other outside sources. The number of self-supported full-time graduate students grew by 3 percent during this period (chart 2) and represented 36 percent of the total.

Chart 2. Full-time graduate science/engineering enrollment in doctorate-granting institutions by source of major support



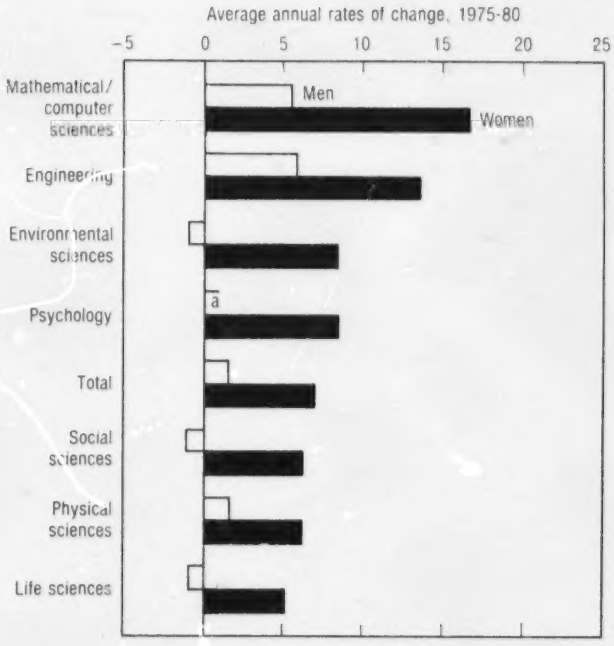
[a]Including State and local government support.
[b]Less than 0.05 percent.
SOURCE: National Science Foundation

WOMEN GRADUATE STUDENTS

Of the 231,000 full-time graduate students enrolled in 1980 in S/E programs at doctorate-granting institutions, women represented 33 percent, up from 25 percent in 1975. This should increase the number of women in the S/E labor force, where they constituted less than 10 percent of the 1978 total, as compared to over 40 percent of all professional and related workers. Almost all of the growth in full-time graduate S/E enrollment between 1979 and 1980 was attributable to the increasing number of women continuing their education beyond the bachelor's degree. While the number of men enrolled full time in graduate S/E programs increased by 1 percent, the number of women increased at a rate of 7 percent (chart 3).

The major sources of support of women enrolled full time in doctorate-granting institutions differed significantly from those of men in 1980. Thirty-six percent of the women were supported by family or personal funds compared to 27 percent of the men. There was less difference between the proportion of women and men receiving their major support from their own institutions, 35 percent and 39 percent, respectively. The Federal Government was the major source of support for 22 percent of the women, almost the same proportion as that of men. To some extent the difference in sources of support is a function of the difference in field distributions of the sexes; but the proportion of women relying primarily on self-support was higher than that of men in every major field except the physical sciences.

Chart 3. Full-time graduate science/engineering enrollment in doctorate-granting institutions by area and sex



[a]Less than 0.5 percent change.
SOURCE: National Science Foundation

MINORITY GRADUATE STUDENTS

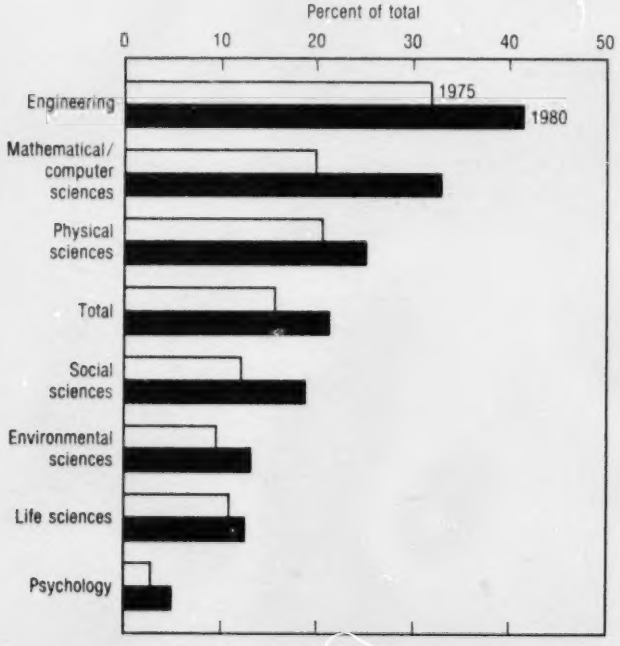
In 1980, respondent institutions provided racial/ethnic data on about five out of every six full-time graduate students with U.S. citizenship (86 percent of those enrolled at doctorate-granting institutions and 63 percent of those at master's-granting institutions).[10] Of the 167,000 full-time students holding U.S. citizenship for whom racial/ethnic data were reported in 1980, 89 percent were reported as White, non-Hispanic. Less than 4 percent were Black non-Hispanic; Asians and Pacific Islanders comprised another 3 percent, as did Hispanics. American Indians and Alaskan natives made up less than one-half of 1 percent of the 1980 total. Virtually the same pattern prevailed in terms of the racial/ethnic distribution of all 1979 baccalaureate-holders, although Black non-Hispanics had a slightly heavier representation, 7 percent. They were also more strongly represented in the 1980 graduate enrollment totals reported by National Center for Education Statistics in all fields—6 percent.[11]

FOREIGN GRADUATE STUDENTS

Although the number of foreign full-time S/E graduate students enrolled in doctorate-granting institutions increased by 9 percent between 1979 and 1980, the number of U.S. citizens enrolled for advanced study grew by only 2 percent.

During the previous 4-year period, the number of foreigners enrolled increased at an average annual rate of 8 percent, whereas the number of U.S. citizens remained virtually unchanged. In 1980, foreigners made up 21 percent of all full-time S/E graduate students in doctorate-granting institutions, up from 16 percent in 1975. The proportion of foreign students varied from 42 percent of all engineering graduate students and 33 percent of those in the mathematical/computer sciences to 5 percent of those in psychology. In each field, however, the proportion of foreigners was greater in 1980 than in 1975 (chart 4).[12]

Chart 4. Foreign as a percent of total full-time graduate science/engineering enrollment in doctorate-granting institutions by area



SOURCE: National Science Foundation

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Copies of *Academic Science: Graduate Enrollment and Support, Fall 1980 (Detailed Statistical Tables)* (NSF 81-330) are available from the Division of Science Resources Studies, National Science Foundation, Washington, D.C. 20550. For information on availability of data tapes, please call J. G. Huckenpahler at (202) 634-4673.

Footnotes

[1] Department of Education, National Center for Education Statistics, *Fall Enrollment and Compliance Report of Institutions of Higher Education, annual series* (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office). Data for 1980 are preliminary.

[2] Department of Education, National Center for Education Statistics, *Education in the United States (Statistical Highlights Through 1979-80)* (NCES 81-401) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office), table 6, p. 38.

[3] Atelsek, Frank J. and Irene L. Gomberg, *Recruitment and Retention of Full-time Engineering Faculty, Fall 1980*, Higher Education Panel Report Number 52 (Washington, D.C.: American Council on Education, October 1981), table 1.

[4] National Science Foundation, *Academic Science: Scientists and Engineers, January 1981* (Detailed Statistical Tables (NSF 82-305) (Washington, D.C., 1982), table B-4.

[5] Gillespie, Robert G., *Computing and Higher Education: An Accidental Revolution*, a study funded by NSF grant number SED 78-23790 (Seattle, Wash.: University of Washington), 1981.

[6] Data on sources and types of major support were not collected on part-time graduate students.

[7] Data on types of major support of full-time graduate students were not collected until 1980 from master's-granting institutions.

[8] National Science Foundation, *Academic Science: R&D Funds, Fiscal Year 1980* (Detailed Statistical Tables) (NSF 82-300) (Washington, D.C., 1982), table B-4.

[9] National Science Foundation, *Federal Support to Universities, Colleges, and Selected Nonprofit Institutions, Fiscal Year 1979* (Detailed Statistical Tables) (NSF 81-308) (Washington, D.C., 1981), table B-1, p. 20.

[10] Although data on racial/ethnic distribution of graduate S/E students were requested on an "optional" basis in 1979, responses were received from less than one-half of the departments surveyed.

[11] Department of Education, National Center for Education Statistics, *Fall Enrollment and Compliance Report of Institutions of Higher Education, op. cit.*, unpublished data for 1980.

[12] For a more detailed discussion of foreign students enrolled for S/E graduate degrees in U.S. universities, see National Science Foundation, *Foreign Participation in U.S. Science and Engineering Higher Education and Labor Markets* (NSF 81-316) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office, 1982), pp. 1-12.

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